DEVELOPMENT OF A PREFORMING AND MANUFACTURING PROCESS FOR PREPREG MATERIALS IN THE TRANSPORTATION INDUSTRY

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Recent improvements in thermoset resin chemistry now make available fast cure structural prepreg materials that allow the development of cost-effective manufacturing process for composites in the automotive and transportation industry. As such, the increasing use of structural composite parts in the automotive industry calls for the development of cheap and low cycle time manufacturing processes. While fast resin chemistry will enable the reduction of the composite thermoset cure time, preforming process time also needs to be reduced to meet high volume requirement of this industry.

This paper presents the development of a 5-minute cycle time automated preforming process. The developed process targeted mainly convex geometries and consisted in preforming an entire 2D stack up of the prepreg plies rather than using a ply-by-ply approach and using a reusable flexible membrane. Process automation technologies have been developed to allow this process to reach the desired production volume. These automation technologies included the development of robot end-effectors for the manipulation of the 2D stack and removal of the prepreg backing film. The developed process allowed to reach the target cycle time for parts up to 2.5 mm. At the end of the preforming steps, preforms had some significant defects such as wrinkles and bridging. Preformed were then consolidated using isothermal compression moulding process. Cure was completed after 7 minutes. High quality component was produced with minor defects such as few resin rich areas and minor wrinkles.

Although the automated membrane preforming did not produce a perfect preform, the compression moulding process resulted in a high-quality composite component. With a total manufacturing time from ply stack-up to demoulding under 15 minutes, this developed process opens the door for the use of thermoset composite materials for high volume structural applications. Future work aims to integrate these solutions into a prototype automated cell to optimise the process and assess the viability in the transportation industry.

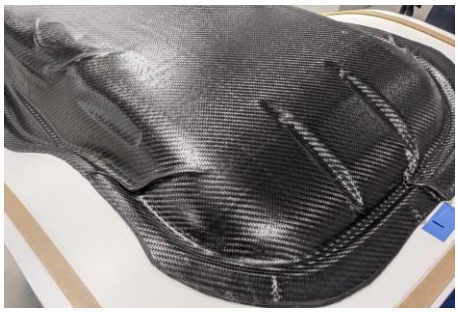
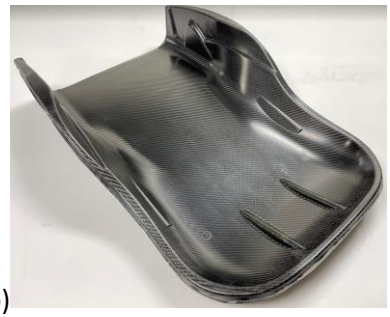
a)  b) 

Figure 1: Prototype seat back part manufactured using the developed preforming and moulding processes: a) prepreg prefom, b) consolidated component